ECE101B Homework 2:

This section is for the solution to problem 7.17. Here we are asked to plot the skin depth as a fucntion of frequency. To do so we have generated a script to best plot out the function. This was done through calculating the alpha value for each frequency given the system parameters. This value was then inverted as skin depth is defined as $\frac{1}{\alpha}$. Note that we used the general equation as a cursory check verified that we cannot make a single approximation for the band of frequencies between 1000 Hz and 10GHz.

MATLAB Code

The code used to generate this plot is shown below:

```matlab
%% ECE101B: Hw2
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%Date: 4/15/20

clc;clear;close all;
%% 7.18
ur =1;
er=80;
sigma=4;
E = er*8.854e-12;
mu = ur*1.256e-6;

E_prime = E;
frequency = [1000:1000:10e9];
E_double_prime = sigma./(2*pi*frequency);
alpha = zeros(1,length(frequency));

for i =1: length(alpha)
    alpha(i) = 2*pi*frequency(i)*sqrt((mu*E_prime/2)*...
        (sqrt(1+(E_double_prime(i)/E_prime)^2)-1));
end

skin_depth_plot = figure(1);
loglog(frequency, 1./alpha);
xlabel('frequency (Hz)');
ylabel('Skin Depth (m)');
title('7.18 :skin depth v.s. frequency');
saveas(skin_depth_plot, 'skin_depth_plot.jpg');
```

Result

The generated plot is shown in Figure 1. The plot shows the general trend of the skin depth decreasing as frequency increases. This makes sense as higher frequency values should have a smaller skin depth.
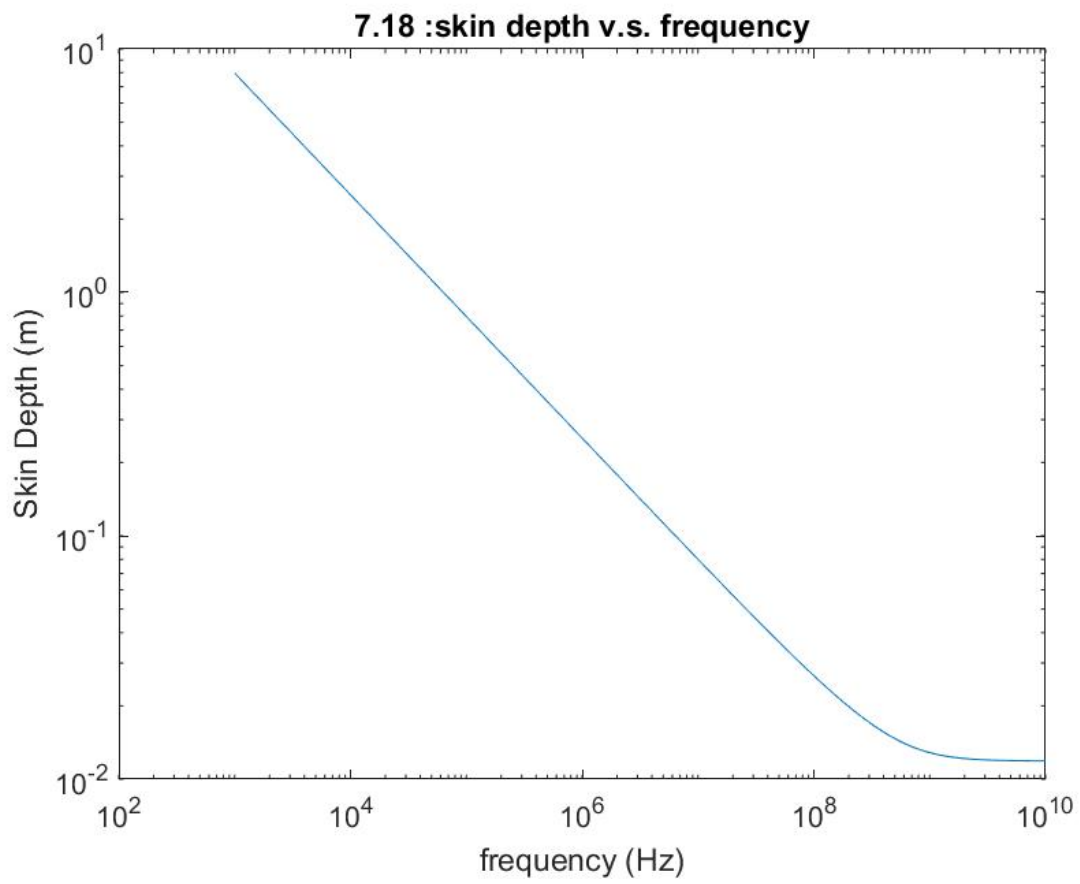
Figure 1: 7.17